Mangrove soil and vegetation change after tidal wetland creation: a 20-year chronosequence in Tampa Bay, FL

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Mangrove restoration and creation efforts are increasingly proposed as mechanisms to compensate for mangrove loss (which has been high in recent decades: ~30-50% global loss). However, ecosystem development and functionality following mangrove restoration and creation is poorly understood. In this study, we used a 20-year chronosequence of created mangrove sites in Tampa Bay, FL to compare created and natural wetlands and quantify the rate of soil and vegetation change following mangrove creation. Our study design included nine created wetlands of different ages (0-20 years) and nine natural reference wetlands. We quantified soil properties at two depths (0-10 cm and 10-30 cm) and compared vegetation at multiple canopy strata. Since natural mangroves typically have high soil carbon pools (i.e., deep peat) and created wetlands begin as uplands, we were especially interested in the rate of soil change following wetland creation. Relative to natural mangroves, the created wetland soils had significantly higher bulk densities, higher sand content, lower soil organic matter (SOM), lower total carbon (TC), and lower total nitrogen (TN), especially in the deeper layer (10-30 cm). In the upper soil layer (0-10 cm), a shallow carbon-rich peat layer developed; SOM, TC, and TN in this layer increased rapidly with created wetland site age. Across the 20-year chronosequence, our sites underwent succession from salt marsh to mangrove-dominated communities. Whereas salt marsh grass stem density, cover, and biomass decreased significantly with site age, mangrove tree diameter and density increased significantly with site age. After twenty years, adult tree diameter and density in the created wetlands was still significantly smaller than in the natural mangroves. Plant and soil change across the chronosequence were tightly linked indicating that forest growth was likely driving the relatively rapid peat development in the surface soil layer. In addition to illustrating relatively rapid soil and forest change after mangrove creation, our findings quantify key differences between natural and created wetlands which is valuable information for natural resource managers wishing to sustain existing mangroves or restore functionality via wetland creation or restoration.